

PREVIOUSLY PRESENTED AND CURRENTLY AMENDED

Claims 1-38 (ORIGINAL) - CANCELLED

39. (CURRENTLY AMENDED) A method for operating a temperature controllable and pressurizable fixed volume pressure filter apparatus formed with an openable filtration chamber for separating a quantity of slurry (124) into slurry solids and slurry liquids to form a substantially dry slurry solids filter cake, said apparatus comprising:

at least one pressure sealable fixed volume filtration chamber (120) consisting of an upper inlet plate (100) having an inlet cavity (106), a lower outlet plate (102) having an outlet cavity (116), said inlet plate and outlet plate having continuous mating surfaces to form a sealable internal cavity, said inlet plate having entry port means (108) into said sealable internal cavity and said outlet plate having exit port means (118) for exit from said internal cavity, said lower outlet plate including a fixed porous support grid (112) adjacent to said mating surfaces, said filtration chamber of fixed volume being formed between the interior of said inlet cavity and the surface of said porous grid when said mating surfaces of said inlet plate and outlet plate are sealed against each other, means for opening and closing said filtration

chamber by relatively moving said upper and lower plates,

a movable porous filter medium(104), said medium being disposed within said filtration chamber between said continuous mating and sealing surfaces of said upper and lower plates and supported on said fixed porous support grid when said filtration chamber is closed and movable through said filtration chamber when said filtration chamber is open.

means for moving said filter medium through said filtration chamber when said filtration chamber is open,

a source of slurry, said source of slurry (124) coupled with said at least one filtration chamber through said input port means when said plates are closed,

at least one source of temperature controllable and pressurizable fluid (126,128,130,132) coupled with said at least one filtration chamber through said input port means when said plates are closed,

separate valving means (A,B,D,E,F) for controlling entry of said slurry and said temperature controlled and pressurizable fluid into said at least one filtration chamber after each closing of said filtration chamber,

means for controlling said separate valving means (80) to uniformly distribute said slurry into said filtration chamber after each closing of said filtration chamber

and for introducing said temperature controllable and pressurizable fluid into said filtration chamber when said filtration chamber is closed for separating slurry liquid from said slurry and passing said separated slurry liquid through said exit port means to form said slurry solids filter cake on said filter medium,

and means for moving said filter medium through said filtration chamber after each closing of said filtration chamber and when said filtration chamber is open by separation of said plates for discharging said slurry solids filter cake (104) from said apparatus,

the method including ~~improvement characterized by the method steps of :~~

- ~~— a) closing of said upper and lower plates to establish said filtration chamber with said filter medium between said continuously mating surfaces,~~
- ~~— b) uniformly distributing said quantity of slurry (124, B, 108) in said at least one filtration chamber (120),~~
- ~~— c) introducing a hot gas fluid (126, A, 108) into said filtration chamber to displace slurry liquids from said slurry to form said substantially dry filter cake on said filter medium,~~

a) after each closing of said upper and lower plates to establish said at least one pressure sealable fixed volume sealed filtration chamber with said filter medium

supported within said filtration chamber between said continuously mating surfaces,
uniformly distributing said quantity of slurry (124, B, 108) in said at least one sealed
filtration chamber (120) after said closing of said filtration chamber, pressurizing and
temperature controlling said sealed filtration chamber,

b) after forming said sealed filtration chamber forcing a first portion of said
slurry liquid from said distributed slurry through the said filter medium (104) and
through said exit port means in said sealed filtration chamber with a first quantity of
said temperature controllable and pressurizable fluid (D,E,F, 108) to initiate
formation of a filter cake of slurry solids within said filtration chamber on said filter
medium, and

c) after forming said filtration chamber and while said sealable filtration chamber
is closed and temperature and pressure controlled, passing dry hot gas fluid (A ,108)
through said filter medium (104) and initially formed filter cake to displace a further
portion of said slurry liquid from said filter cake and through said exit port means to
form said substantially dry slurry solids filter cake on said filter medium,

d) e opening said filtration chamber by relatively moving said upper and lower
plates,

e) f then moving said substantially dry slurry solids filter cake on said filter

medium through said open filtration chamber,

f) ~~g~~ discharging from said open filtration chamber and from said filter medium
(104) said substantially dry slurry solids filter cake from said filtration chamber
formed during said ~~single~~ each closing of said filter apparatus on said filter medium,
and

h) repeating said steps a) through f) for successive closing and opening of said
upper and lower plates in repeated operation of said pressure filter apparatus and for
forming said substantially dry filter cake on said filter medium.

40. (CANCELLED)

41. (CURRENTLY AMENDED) The method of claim 40 39 wherein said dry hot
gas fluid is ~~steam~~ temperature and pressure controlled.

42 (CURRENTLY AMENDED) The method of claim 41 wherein said ~~steam~~ dry hot
gas is dry steam.

43. (CURRENTLY AMENDED) The method of claim 41 wherein said dry hot gas is
hot air, hot inert gas or steam, or combinations thereof.

44. (CURRENTLY AMENDED) The method of claim 41 wherein said hot gas fluid
is hot gas or hot air, hot inert gas or steam, or combinations thereof, and is passed
through said initially formed filter cake during each closing of said filter apparatus in

a sequence of individual selection of hot air, hot inert gas or steam, or combinations thereof, in an order determined by an initial analysis of the slurry to be separated into slurry solids and slurry liquid.

45 (CURRENTLY AMENDED) The method of claim ~~39~~ 40 wherein said slurry is initially pre-treated with heat from hot air, hot inert gas or steam, or combinations thereof during each closing of said filter apparatus, while being uniformly distributed in said filtration chamber.

46. (CURRENTLY AMENDED) The method of claim 39 ~~40~~ wherein during each closing of said filter apparatus introducing said first portion of said introduced temperature controllable and pressurizable fluid includes using hot wash fluid.

47. (CURRENTLY AMENDED) The method of claim 40 ~~39~~ wherein said filtration chamber is preheated prior to having said slurry uniformly distributed therein.

48. (PREVIOUSLY PRESENTED) The method of claim 47 wherein said fixed volume filtration chamber when sealed is pressurized with hot gas, hot inert gas, steam, or combinations thereof, prior to having said slurry uniformly distributed therein.

49. (PREVIOUSLY PRESENTED) The method of claim 44 wherein said sequence of passing hot air, hot inert gas or steam, or combinations thereof, through said filter

cake is a repeated sequence of selected hot air, hot inert gas or steam, or combinations thereof.

50. (PREVIOUSLY PRESENTED) The method of claim 39 with the additional step of passing air or gas through said filter cake after said hot gas to cool said filter cake prior to discharging said dry filter cake from said open filtration chamber.

51. (CURRENTLY AMENDED) The method of claim 39 wherein said ~~slurry fluid~~ displaced slurry liquid from said pressurized filtration chamber is recirculated into contact with said slurry or hot gas to transfer heat from said displaced slurry liquid ~~fluid~~ to preheat said slurry or hot gas.

52. (PREVIOUSLY PRESENTED) The method of claim 39 wherein said introduced hot gas fluid is hot air, hot gas or dry steam at elevated temperature and pressure when introduced into said filtration chamber and when exiting from said chamber.

53. (PREVIOUSLY PRESENTED) The method of claim 52 wherein said hot gas fluid is at a temperature of about 80 ° C to about 230 ° C.

54. (PREVIOUSLY PRESENTED) The method of claim 52 wherein said hot gas fluid is at a pressure about -55.16kPa (-8.0psi) to about 2,757.92kPa (400psi).

55. (PREVIOUSLY PRESENTED) The method of claim 39 wherein said dry hot gas

fluid is selected by analysis of said slurry to be separated so as to prevent unwanted structural changes in said slurry solids in said filter cake formed in said pressurized filtration chamber.

56. (PREVIOUSLY PRESENTED) The method of claim 39 wherein means are provided in or associated with said filtration chamber for sensing conditions of temperature, pressure and filter cake formed condition, or combinations thereof, for controlling the distribution of said slurry in said filtration chamber and for controlling the introduction of said dry hot gas fluid to said filtration chamber during each closing of said filter apparatus.

57. (PREVIOUSLY PRESENTED) The method of claim 56 including controlling said distribution of slurry into said filtration chamber and said passing of said dry hot gas fluid in accord with said sensed conditions within said pressurized filtration chamber.

58. (PREVIOUSLY PRESENTED) The method of claim 39 including the step of sealing said filtration chamber during each closing of said filter apparatus prior to distribution of said slurry, and then elevating the pressure in said sealed filtration chamber to a predetermined pressure.

59. (CURRENTLY AMENDED) The method of claim 39 wherein said at least one

filtration chamber has a plurality of ~~input~~ entry ports and exit ports for selectively entering said slurry or said hot gas fluid into said filtration chamber and for exiting liquids and hot gas fluid from said filtration chamber

60. (CURRENTY AMENDED) A pressure filter apparatus for separating a slurry (124) into separated slurry liquids and slurry solids and for forming a substantially dry slurry solids filter cake on a filter medium from said slurry during a single closing of said filter apparatus ~~characterized by~~ comprising:

~~[at least one pressure sealable filtration chamber (120) consisting of continuous mating surfaces of upper and lower plates, means for opening and closing said filtration chamber by relatively moving said upper and lower plates, —a filter medium, said medium being disposed between and sealed between said continuous mating surfaces of said upper and lower plates,]—~~

a) an upper inlet plate (100) having an inlet cavity (106), a lower outlet plate (102) having an outlet cavity (906), said inlet plate and outlet plate having continuous mating surfaces to form a sealable internal filtration chamber (120), said inlet plate having entry port means (108) into said sealable internal filtration chamber and said outlet plate having exit port means (118) for exit from said filtration chamber, said lower outlet plate including a fixed porous support grid

(112) adjacent to said mating surfaces, a fixed volume filtration chamber being formed between the interior of said inlet cavity and the surface of said porous grid when said mating surfaces of said inlet plate and outlet plate are sealed against each other, means for temperature controlling and pressurizing said formed fixed volume filtration chamber,

b) a filter medium (104), said medium being supported on said fixed surface of said grid (112) and sealed between said continuous mating surfaces of said upper and lower plates while said plates are closed and during each closing of said filter apparatus and movable through said filtration chamber when said filtration chamber is open,

c) means for moving said filter medium through said filtration chamber when said upper and lower plates are separated and when said filtration chamber is open,

d) a source of slurry (124) coupled with said ~~at least one~~ fixed volume filtration chamber during each closing of said filter apparatus and when said plates are closed,

e) at least one source of temperature controllable and pressurizeable fluid (126,128,130,132) coupled with said ~~at least one~~ filtration chamber at said entry port means during each closing of said plates during forming of said filtration

chamber, said temperature controllable and pressurizeable fluid being controllable to maintain said fluid in dry condition when within said pressurized filtration chamber,

f) separate valving means (A,B,D,E,F) for controlling entry of said slurry and said temperature controllable and pressurizable fluid into said ~~at least one~~ filtration chamber at said entry port means during each closing of said plates forming said filtration chamber,

g) means for controlling said separate valving means (80) to uniformly distribute said slurry into said filtration chamber and for introducing said temperature controllable and pressurizable fluid into said filtration chamber during each closing of said plates during forming of said filtration chamber to pressurize and control said filtration chamber and for passing said temperature controllable and pressurizable fluid through said slurry within said fixed volume filtration chamber for separating slurry liquid for exit at said exit port from said slurry to form said slurry solids cake on said filter medium,

h) means for controlling movement of said filter medium through said filtration chamber when said filtration chamber is open for discharging said slurry solids cake (104) from said filter apparatus on said filter medium, and

i) means for controlling repeated operations of said means in paragraphs a) through h) in repeated closings of said plates for forming a filtration chamber and separation of slurry liquid from slurry solids.

61. (CURRENTLY AMENDED) The apparatus of claim 60 wherein said at least one source of temperature controllable and pressurizable fluid coupled to said at least one filtration chamber at said entry port includes a source of temperature controllable and pressurizable hot gas.

62. (PREVIOUSLY PRESENTED) The apparatus of claim 61 wherein said source of hot gas (126) includes hot air, hot inert gas, or steam, or combinations thereof.

63. (PREVIOUSLY PRESENTED) The apparatus of claim 61 wherein said source of temperature controllable and pressurizable fluid includes a steam source (809) that produces steam at elevated pressure and temperature.

64. (PREVIOUSLY PRESENTED) The apparatus of claim 60 wherein said means for controlling said separate valving means is a programmable controller (80) that can be programmed to pass said slurry and said at least one source of temperature controllable and pressurizable fluid into said at least one filtration chamber during each formation of a filtration chamber in a desired sequence of any one or all of the

following steps:

initiating the formation of a filter cake,

dewatering said cake,

washing said cake,

changing the temperature of said cake, or

discharging said cake from said filter apparatus.

65. (PREVIOUSLY PRESENTED) The apparatus of claim 60 wherein said apparatus includes means for coupling said separated slurry liquids with at least one of said sources of slurry or said source of temperature controllable and pressurizable fluid to pretreat said sources prior to entry into said filter apparatus.

66. (CURRENTLY AMENDED) The apparatus of claim 64 wherein said programmable controller (80) is programmed to apply hot air, hot inert gas or steam, or combinations thereof, in preprogrammed sequences from said at least one source of temperature controllable and pressurizable fluid to produce said substantially dry filter cake.

67. (PREVIOUSLY PRESENTED) The apparatus of claim 60 having a source of compressed air (130, 132), a source of inert gas (130, 132), and a steam source (126) being connected to said apparatus and said source of temperature controllable and

pressurizable fluid being coupled with said source of compressed air, source of inert gas and steam source to coordinate pressure, temperature and conditions within said formed filtration chamber (120) with conditions in said source of compressed air, source of inert gas and steam source.

68. (CURRENTLY AMENDED) The apparatus of claim 60 including means for supplying wash fluids (128) to said ~~at least one fixed volume~~ formed filtration chamber during each closing of said filter apparatus for treating said substantially dry filter cake.

69. (CURRENTLY AMENDED) The apparatus of claim 60 ~~including a~~ wherein said filter medium (104) is disposed within said at least one filtration chamber (120) for supporting said substantially dry filter cake, and said means for transporting (115,117) said filter medium through said filtration chamber [, and] includes means for cleaning (400, 402) said filter medium after said slurry solids cake has been discharged from said filtration chamber on said filter medium.

70. (PREVIOUSLY SUBMITTED) The apparatus of claim 60 wherein said means for cleaning is a driven brush (300) mechanism (402) that contacts said filter medium.

71. (PREVIOUSLY SUBMITTED) The apparatus of claim 60 wherein said cleaning means includes a source of fluid (804) for cleaning and treating said filter medium.

72. (CURRENTLY AMENDED) The apparatus of claim 60 including vibrator means (200) connected to said formed filtration chamber for vibrating said chamber during said discharge of said dry filter cake from said apparatus.

73. (CURRENTLY AMENDED) The apparatus of claim 60 wherein said apparatus includes:

a plurality of upper and lower plates for forming a plurality of fixed volume filtration chambers in operating cooperation and each formed filtration chamber operating to separate liquids and solids in a slurry during each closing of each filtration chamber,

said source of slurry coupled to each of said plurality of formed filtration chambers,

said source of temperature controllable and pressurizable fluid coupled to each of said formed filtration chambers,

said separate valving means includes valving means associated with each of said filtration chambers, and

said means for moving said filter medium for discharging said dry filter cake from said filtration chamber is coupled to each of said plurality of formed filtration chambers.

74. (CURRENTLY AMENDED) A pressure filter apparatus according to claim 60 wherein said at least one filtration chamber is a dual sided filtration chamber including filter media on both sides of said chamber,

said slurry input means is connected to said formed filtration chamber between said filter media on both sides of said chamber,

said at least one source of temperature controllable and pressurizable fluid is coupled to said filtration chamber between said filter media, said at least one source of temperature controllable and pressurizable fluid including hot gas, inert gas and steam, or combinations thereof,

said apparatus includes a flexible diaphragm in cooperating engagement with said filter media,

and fluid means coupled to said flexible diaphragm for squeezing said diaphragm against said filter media for removing liquids ~~from~~ from said slurry within said filtration chamber and for forming said substantially dry filter cake on said filter media.